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PATTERSON & SHERIDAN, L.L.P.
3040 POST OAK BOULEVARD
SUITE 1500
HOUSTON, TX 77056

EXAMINER	
BUCHANAN, JACOB	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/563,290	BURCHARDT, TRYGVE	
	Examiner	Art Unit	
	Jacob Buchanan	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 January 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4 January 2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because of minor spelling errors (e.g. “Callender” on Figure 1 and "Gavlanostatic" on Figure 3). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: “in a single pass [PATH??] process” on page 3, line 11 of the specification is not clear.

Appropriate correction is required.

Claim Objections

3. Claim 1 is objected to because of the following informalities: "in a dry form to produce a dry an agglomerate" in lines 3-4 should read --in a dry form to produce a dry agglomerate--. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 9, 12-15, and 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "slowly" in claim 9 is a relative term which renders the claim indefinite. The term "slowly" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is not clear how slowly should the solvent be added to read on the claimed invention.

Claim 12 recites the limitation "said film" in line 2. There is insufficient antecedent basis for this limitation in the claim. For the purpose of this office action, this limitation has been interpreted as --said sheet--, as recited in claim 1 line 6 and as described on page 8 lines 10-11 of the specification.

Claims 13-15 recites the limitation "the powder mixture forming the active layer" in lines 1-2 of all the recited claims. There is insufficient antecedent basis for this

limitation in the claim. For the purpose of examination, this limitation has been interpreted as:

"the powder mixture which is agglomerated is 100 wt% graphite"

Claim 25 provides for the use of the gas diffusion electrode according to claim 23, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claim 25 is rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. Claims 1, 4-6, 9, 12, 17-23, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217).

Regarding claim 1, Plowman discloses a method of manufacturing a gas diffusion electrode (abstract) comprising:

- Adding an organic solvent to a dry agglomerate to produce a paste (C6/L10-16)
- Calendering the paste into a thin sheet with a thickness less than 1mm, to form an active layer or gas diffusion layer (C6/L16-29), one or both of said layers containing a current collector (C6/L30-37)
- Combining said active layer and said gas diffusion layer to form a gas diffusion electrode (C6/L30-37)

Plowman continues to disclose that a filter cake, comprising carbon black and a hydrophobic halocarbon polymer (i.e. PTFE) (C6/L37-40), is obtained from forming a dispersion of the carbon black and PTFE (C6/L42-46). The filter cake is transferred to a

container suitable for oven drying to obtain a coarse, dry aggregate which is subsequently ground to a fine powder (C6/L57-60) using a low speed blender (C11/L15-16). While Plowman discloses a method of manufacturing a gas diffusion electrode including a filter cake comprising carbon and PTFE that is subsequently ground, the reference does not explicitly disclose agglomerating a powder mixture with PTFE particles.

Sauer discloses a method of manufacturing a plastic bonded active carbon layer for thin gas diffusion electrodes (C1/L5-8). The method includes subjecting a dry mixture of active carbon and PTFE powder in a paddle mixture (1), prior to rolling and pressing, additionally to the intensive subdividing effect of rapidly rotating sharp knives (6) of a blender (C1/L63-68). The rate of rotation of a motor (7) driving the knives (6) is disclosed of reaching a rate of rotation equal to about 3000 rpm (C2/L27-30).

Plowman and Sauer are analogous because they are both concerned with the same field of endeavor, the manufacture of gas diffusion electrodes.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the method of subjecting a dry powder of carbon and PTFE to blending, as taught by Sauer, with the method of preparing a dry agglomerate comprising carbon and PTFE, as taught by Plowman, for the purpose of having an agglomeration of dry carbon and PTFE without the need to filter and oven bake an agglomeration of carbon and PTFE from a dispersion.

Regarding claim 4, modified Plowman discloses all of the claim limitations as set forth above. Sauer additionally discloses the method characterized in that

agglomeration is carried out using a blender with blades (6) rotating at 1000-3000 rpm (C2/L27-30).

Regarding claim 5 modified Plowman discloses all of the claim limitations as set forth above. Plowman additionally discloses in that the powders are heated to a temperature in the range of 50-200C prior to step (a) (C11/L14-16).

Regarding claim 6, modified Plowman discloses all of the claim limitations as set forth above. Sauer additionally discloses the method characterized in that an agglomeration time of at least 1 minute is used (C2/L34-39).

Regarding claim 9, modified Plowman discloses all of the claim limitations as set forth above. While the Plowman discloses a liquid dispersion medium, preferably an organic medium, added to the dry powders in a suitable amount so that a cohesive and pliable dough results (C6/L13-16), neither reference explicitly discloses the method characterized in that the solvent is added to the agglomerate with stirring. As most mixtures of dry particles and a liquid dispersion do not readily form a pliable dough without a form of agitation, it would have been obvious to one of ordinary skill in the art at the time of invention to use a method of agitation such as stirring to mix the dry particles and liquid to create a pliable dough.

Regarding claim 12, modified Plowman discloses all of the claim limitations as set forth above. Plowman additionally discloses the method characterized in that a current collector mechanical support is calendered into said film (C6/L45-52).

Regarding claim 17, modified Plowman discloses all of the claim limitations as set forth above. Sauer additionally discloses the method characterized in that the

powder mixture comprises 55-75 wt% **activated carbon** or graphite and 25-45 wt% PTFE (see "preferably 3:1 to 2:1", C2/L15-19).

With regard to claim 18, the addition of a further gas diffusion layer made according to the method described in steps (a)-(d) for the purpose of preventing liquid from entering the gas chamber (specification, page 8, lines 15-16), would have been obvious to one having ordinary skill in the art at the time the invention was made. Mere duplication of parts has no patentable significance unless a new and unexpected result is produced. *In re Harza,* 124 USPQ 378, 380 (CCPA 1960). Further, it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8. See MPEP 2144.

Regarding claim 19, modified Plowman discloses all of the claim limitations as set forth above. Plowman additionally discloses the method characterized in that said layers are combined in step (d) by calendering or pressing (C6/L45-52).

Regarding claim 20, modified Plowman discloses all of the claim limitations as set forth above. While neither reference explicitly disclose a method characterized in that said electrode is dried at a temperature less than 40C, Plowman does disclose that subsequent to lamination of the active layer, current collector, and backing layer, the electrode was heated to 200C to remove VARSOL, the organic solvent (C11/L68-C12/L2). As the operational cost of drying or removing a solvent from a mixture and drying rate are variables that can be modified, among others, by adjusting said temperature of drying, with said operational costs and drying rate both increasing with an increase of temperature, the precise temperature cannot be considered critical.

Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the temperature of drying in the method of Plowman to obtain the desired balance between the operational cost and the drying rate (*In re Boesch,* 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144. Additionally, one of ordinary skill in the art would recognize the ability of air drying said electrode at ambient temperature.

Regarding claim 21-22, modified Plowman discloses all of the claim limitations as set forth above. Plowman and Sauer additionally disclose the method characterized in that said steps are performed in a continuous production line, and the method characterized in that said gas diffusion layer and said active layer are produced in parallel continuous production lines and said production lines are combined in the combining step.

For clarification, Sauer discloses a method of agglomerating PTFE and carbon that takes place in a mixer (1) with paddles (3) and knives (6). After the treatment, the agglomeration is removed via outlet port (8) into a storage container (10) (C2/L36-39). The container (10) has a drive (11) for powder transport (C2/L43-45) that appears to be in a shape of stirring apparatus (Figure 2). It would have been obvious to one of ordinary skill in the art at the time of invention to simultaneously add an organic solvent, as disclosed by Plowman, with the storage tank and drive, as taught Sauer, for the

purpose of creating a creating a paste or dough to form a gas diffusion layer or active layer.

After the mixture leaves the storage container (10) of Sauer, the mixture moves into a crusher (12) with a rotating disk (13) to assure that material is pourable through inlet chute (14) in order to reach the rollers (15) (C2/L42-49, Figure 2). In other words, the crusher and the chute appear to work together as an extrusion apparatus that feeds into rollers which act as a calendering apparatus as the paste/dough/mixture passes through.

Afterwards, the calendered material (16) passes through a second roller set (19) where a woven metal band (18) (a current collector) is calendered to the material (16) (C2/L50-56). It would have been obvious to one of ordinary skill in the art at the time of invention to combine the calendering process of an additional substance, as taught by Sauer, with the method of making the active and gas diffusion layer, as taught by Plowman, for the purpose of preparing both active and gas diffusion layers simultaneously and calendering them together in a seamless finishing process.

Regarding claim 23, modified Plowman discloses all of the claim limitations as set forth above. Plowman additionally discloses an electrode manufactured by the method according to claim 1 (C12/L21-24).

Regarding claim 25, modified Plowman discloses all of the claim limitations as set forth above. Plowman additionally discloses the use of the gas diffusion electrode according to claim 23 in fuel cells, metal-air batteries or membranes (C1/L7-10, C4/L45-48).

11. Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1, 4-6, 9, 12, 17-23, and 25 above, and further in view of Takeuchi et al. (US 5,571,640).

Regarding claim 2, modified Plowman discloses all of the claim limitations as set forth above. While Plowman discloses the method to manufacture a gas diffusion electrode, the reference does not explicitly disclose the method characterized in that the agglomeration is carried out using a ball mill for mixing.

Takeuchi discloses the method of making a cathode material for an electrochemical cell (C3/L45-50) wherein the ground cathode material is mixed with conductive diluents and a suitable binder material (C3/L52-55). A ball mill or vertical ball is preferred and typical grinding time ranges from between about 10 to 15 minutes (C4/L63-65). It is additionally disclosed that the finely divided cathode material is preferably mixed with carbon black and/or graphite as conductive diluents and a powder fluoro-resin such as PTFE powder as a binding material is used (C4/L65-C5/L2).

Takeuchi and Sauer are analogous because they are both concerned with the same field of endeavor, the manufacturing of a material for an electrochemical cell.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the ball mill for grinding, as taught by Takeuchi, with the method of mixing an agglomeration of powders, as taught by Plowman, for the purpose of grinding and mixing powders together.

Regarding claim 3, modified Plowman discloses all of the claim limitations as set forth above. While Takeuchi discloses that the use of ball mill or vertical ball is preferred and typical grinding time ranges from between about 10 to 15 minutes (C4/L63-65), the reference does not explicitly disclose the method characterized in that the powders are mixed for more than 30 minutes. As the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said mixing time, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise mixing time cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mixing time in the method of Takeuchi to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

12. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1, 4-6, 9, 12, 17-23, and 25 above, and further in view of Santilli et al. (US 5,651,813).

Regarding claim 7, modified Plowman discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose in the method characterized in

that agglomeration is carried out using a high-speed mill with rotating blades which rotate at more than 10,000 rpm.

Santilli discloses a process of making ink jet inks including introducing a mixture into a mill, and milling the mixture until the pigment particle size is below 1.5 μm (C2/L20-35). It is additionally disclosed that milling can take place in any suitable grinding mill including a ball mill but a high speed mill is preferred (C3/L22-25). The high speed mill can contain a rotating shaft with one or more impellers (blades) and it is disclosed that sufficient milling media velocity is achieved when the mill is operated at 9,000 rpm (C3/L28-35).

Santilli and Plowman are analogous because they are concerned with the similar problem of grinding and mixing a particle to a desired size.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the high speed mixer, as taught by Santilli, with the method to agglomerate the particles, as taught by Plowman, for the purpose of making an agglomeration to a desired size via grinding.

Regarding the claim limitation of the speed at which the high speed mill is operated (e.g. "with rotating blades which rotate at more than 10,000 rpm"), as the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said rotation speed, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise rotation speed cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized,

by routine experimentation, the rotation speed in the method of Santilli to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

Regarding claim 8, modified Plowman discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the agglomeration time is from 10 seconds to 5 minutes. As the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said mixing time, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise mixing time cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mixing time in the method of Santilli to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

13. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1,

4-6, 9, 12, 17-23, and 25 above, and further in view of Gascoyne et al. (US 2002/0015879).

Regarding claim 10, modified Plowman discloses all of the claim limitations as set forth above. While Plowman discloses the method to manufacture a gas diffusion electrode, the reference does not explicitly disclose the method characterized in that the agglomerate is heated during stirring.

Gascoyne discloses an improved fuel cell anode structure ([0017]) wherein the anode structure the gas diffusion layer may contain carbon powder such as graphitised carbon, and a polymer such as PTFE ([0027]). Gascoyne continues to disclose a dispersion of carbon-based component, specifically 30 weight parts of high surface area carbon black, and a catalyst component, specifically 100 combined weight parts of platinum and ruthenium catalyst ([0051]). To this is added 10 weight parts of PTFE as a dispersion in water and the mixture is heated and stirred to entrain the PTFE particles within the carbon catalyst materials ([0051]).

Gascoyne and Plowman are analogous because they are both concerned with the same field of endeavor, the making of an electrode for a fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the stirring while heating an aqueous dispersion of PTFE and carbon, as taught by Gascoyne, with the method of making a paste from an organic solvent and agglomerate, as taught by Plowman, for the purpose of entraining the PTFE particles within the carbon catalyst materials.

14. Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1, 4-6, 9, 12, 17-23, and 25 above, and further in view of Kato (US 6,054,230).

Regarding claim 11, modified Plowman discloses all of the claim limitations as set forth above. While Plowman discloses the method to manufacture a gas diffusion electrode, the reference does not explicitly disclose the method characterized in that the paste is extruded into a thin film prior to calendering.

Kato disclose a method to make an electrode consisting of graphite particles (95 wt%) and PTFE resin particles (5 wt%) by conventional paste-forming methods in which the particulate materials were mixed together, lubricated, ram-extruded to form a tape, and calendered to form an electrode sheet (C9/L4-7).

Kato and Plowman are analogous because they are both concerned with the same field of endeavor, the making of an electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the ram-extruded process to form a tape prior to calendering, as taught by Kato, with the method of making a gas diffusion electrode, as taught by Plowman, for the purpose shaping the dough so the calendering process can be performed more easily because the dough has been more effectively distributed.

Regarding claim 13, modified Plowman discloses all of the claim limitations as set forth above. While Plowman discloses the method to manufacture a gas diffusion electrode, the reference does not explicitly disclose the method characterized in that the powder mixture which is agglomerated is 100 wt% graphite.

Kato discloses a method to make an electrode consisting of graphite particles (95 wt%) and PTFE resin particles (5 wt%) by conventional paste-forming methods in which the particulate materials were mixed together, lubricated, ram-extruded to form a tape, and calendered to form an electrode sheet (C9/L4-7). In other words, the powder mixture which is agglomerated is 100 wt% graphite and it is agglomerated with PTFE to form an electrode that is 95 wt% graphite and 5 wt% PTFE.

Kato and Plowman are analogous because they are both concerned with the same field of endeavor, the making of an electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite particles of 95 wt% in an electrode, as taught by Kato, with the agglomeration with PTFE, as taught by Plowman, for the purpose of providing an electrode sheet that displays properties of high electroconductive and lower hydrophobicity.

15. Claims 14-15, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1, 4-6, 9, 12, 17-23, and 25 above, and in view of Binder et al. (US 3,854,994), and further in view of Solomon (US 4,440,617).

Regarding claims 14-15, modified Plowman discloses all of the claim limitations as set forth above. While Plowman discloses the method to manufacture a gas diffusion electrode, the reference does not explicitly disclose the method characterized in that the powder mixture forming the active layer comprises 27-75 wt% graphite with

platinum, and 27-75 wt% graphite, nor comprising graphite with Ag, Co, Fe, perovskites or spinells.

Binder discloses a method of making a porous electrode having an electrically conductive electrocatalytically active layer and a contiguous gas permeable hydrophobic layer comprising polytetrafluoroethylene and carbon powder and graphite fibers (abstract). To enhance the strength and electrical conductivity of the material, graphite fibers or commercial graphitic felt are added (C4/L36-41).

Binder and Plowman are analogous because they are both concerned with the same field of endeavor, the making of a gas permeable electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite fibers or graphite felt, as taught by Binder, with the PTFE powder, as taught by Plowman, for the purpose of making a gas diffusion electrode with enhanced strength and electrical conductivity.

While the references disclose a gas diffusion electrode comprising PTFE and graphite, the references do not explicitly disclose the active layer comprising graphite with platinum, nor with Ag, Co, Fe, perovskites, or spinells.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). For the active layer, the concentration of PTFE in the electroconductive carbon/PTFE mix ranges from about 10 to 40 weight parts of PTFE and from about 60 to 90 weight parts of high surface area carbon to make up 100 weight parts of mix upon drying (C8/L19-23). It is additionally disclosed that platinum can be deposited on the active layer surface (C9/L68-C10/L2),

or other precious metal catalysts such as silver can be deposited to enhance the catalytic activity of the carbon (C10/L16-24).

Solomon and Plowman analogous because they are both concerned with the same field of endeavor, the making of a gas electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the weight percent of the electroconductive carbon and catalyst metals including platinum and silver, as taught by Solomon, with the PTFE powder, as taught by Plowman, for the purpose of making a gas diffusion electrode with enhanced catalytic activity.

Regarding claim 24, modified Plowman discloses all of the claim limitations as set forth above, but the references do not explicitly disclose the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45 wt% PTFE and the active layer comprising 25-75 wt% activated carbon or graphite with noble or non-noble metal catalyst and 25-75 wt% activated carbon or graphite with high surface area (> 100 m2/g) and 5-20 wt% PTFE, the gas diffusion layer and active layer being manufactured according to the method in claim 1.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). Solomon continues to disclose that active carbon can have a BET surface area of from about 1000 m2/g and higher (C6/L65-C7/L2). For the active layer, the carbon black or active carbon particles are combined intimately with the PTFE particles in a procedure referred to as "teflonating" (C8/L13-16). Additionally the concentration of PTFE in the carbon/PTFE

mix ranges from about 10 to 40 weight parts of PTFE and from about 60 to 90 weight parts of high surface area carbon to make up 100 weight parts of mix upon drying (C8/L19-23). It is additionally disclosed that platinum can be deposited on the active layer surface (C9/L68-C10/L2), or other precious metal catalysts such as silver can be deposited to enhance the catalytic activity of the carbon (C10/L16-24).

Solomon and Plowman analogous because they are both concerned with the same field of endeavor, the making of a gas electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the high surface area active carbon containing platinum in the weight percents as stated above, as taught by Solomon, with the active layer of an electrode, as taught by Plowman, for the purpose of having an active layer with high electrical conductivity and many active sites to facilitate the desired reaction.

Plowman modified by Solomon still does not explicitly disclose the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45 wt% PTFE.

For the gas diffusion layer, Binder discloses a method of making a porous electrode having an electrically conductive electrocatalytically active layer and a contiguous gas permeable hydrophobic layer comprising polytetrafluoroethylene and carbon powder and graphite fibers (abstract, C3/38-43). To enhance the strength and electrical conductivity of the material, graphite fibers or commercial graphitic felt are added (C4/L36-41).

Binder and Plowman are analogous because they are both concerned with the same field of endeavor, the making of a gas permeable electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite fibers or graphite felt, as taught by Binder, with the PTFE powder, as taught by Plowman, for the purpose of making a gas diffusion layer with enhanced strength and electrical conductivity.

Regarding the limitation of the weight percent of the activated carbon or graphite and PTFE in the gas diffusion layer (e.g. "the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45% wt% PTFE"). As the electroconductivity and hydrophobicity are variables that can be modified, among others, by adjusting said weight percents, with said electroconductivity and hydrophobicity increasing and decreasing respectively with an increase in the weight percent of activated carbon or graphite, the weight percent cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the weight percents of activated carbon or graphite and PTFE in the method of Plowman modified by Solomon to obtain the desired balance between the electroconductivity and hydrophobicity (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

16. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (US 4,581,116) in view of Sauer (US 4,336,217) as applied to claims 1, 4-6, 9, 12, 17-23, and 25 above, and further in view of Solomon (US 4,440,617).

Regarding claim 16, modified Plowman discloses all of the claim limitations as set forth above, but the references are silent to the physical characteristics of said PTFE with a particle size less than 1mm added to the mixture before the agglomeration step.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). In the active layer, the porous carbon particles are combined with a hydrophobic agent, PTFE (C8/L5-8). The particulate PTFE is disclosed as having individual particle sizes ranging from 0.05 to about 0.5 microns (C8/L8-10).

It would have been obvious to one of ordinary skill in the art at the time of invention to use the particulate PTFE having individual particle sizes ranging from 0.05 to about 0.5 microns, as taught by Solomon, with the PTFE particles for forming an active layer or gas diffusion layer, as taught by Plowman, for the purpose of reducing the mixing time as particles of small size do not have to be mixed or ground as long to become a desired smaller size.

Double Patenting

17. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422

F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

18. Claims 1, 9, 12, 18-19, 23, and 25 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 15 of copending Application No. 11/634379. Although the conflicting claims are not identical, they are not patentably distinct from each other because both claims are directed towards a method of manufacturing a electrode comprising the steps of a) agglomerating a powder to produce a dry agglomerate b) adding an organic solvent to the dry agglomerate to produce a paste c) calendering the paste into a thin sheet to form an active layer or gas diffusion layer d) combining the active layer, gas diffusion layer, and a current collector together to form an electrode.

Regarding claim 9, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the solvent is added to the agglomerate with stirring. As most mixtures of dry particles and a liquid dispersion do not readily form a pliable dough without a form of agitation, it would have been obvious to one of ordinary skill in the art at the time of invention to use a method of agitation such as stirring to mix the dry particles and liquid to create a pliable dough.

Regarding claim 12, the copending application discloses all of the claim limitations as set forth above. The copending application additionally discloses the method characterized in that a current collector mechanical support is calendered into said film (line 13 of claim 15).

With regard to claim 18, the addition of a further gas diffusion layer made according to the method described in steps (a)-(d) for the purpose of preventing liquid from entering the gas chamber (specification, page 8, lines 15-16), would have been obvious to one having ordinary skill in the art at the time the invention was made. Mere duplication of parts has no patentable significance unless a new and unexpected result is produced. *In re Harza,* 124 USPQ 378, 380 (CCPA 1960). Further, it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8. See MPEP 2144.

Regarding claim 19, the copending application discloses all of the claim limitations as set forth above. The copending application additionally discloses the method characterized in that said layers are combined in step (d) by calendering or pressing (line 13 of claim 15).

Regarding claim 23, the copending application discloses all of the claim limitations as set forth above. While the reference does not explicitly disclose an electrode manufactured by claim 1, it would have been obvious at the time of invention to use the method of making a bifunctional air electrode to manufacture an electrode as described by claim 1.

Regarding claim 25, the copending application all of the claim limitations as set forth above. While the copending application does not explicitly disclose the use of the electrode according to claim 23 in fuel cells, metal-air batteries or membranes, the reference does disclose the method of making an electrode of claim 1 (see claim 15 of the copending application) and a bifunctional air electrode for a secondary metal-air battery (claim1 of copending application). It would have been obvious at the time of invention to make the electrode for a metal-air battery using the method of claim 1.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

19. Claim 2-3 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claim 1, in view of Takeuchi et al. (US 5,571,640).

Regarding claim 2, while the copending application discloses the method of manufacturing an electrode including agglomerating a powder, the reference does not explicitly disclose the method characterized in that the agglomeration is carried out using a ball mill for mixing.

Takeuchi discloses the method of making a cathode material for an electrochemical cell (C3/L45-50) wherein the ground cathode material is mixed with conductive diluents and a suitable binder material (C3/L52-55). A ball mill or vertical ball is preferred and typical grinding time ranges from between about 10 to 15 minutes (C4/L63-65). It is additionally disclosed that the finely divided cathode material is

preferably mixed with carbon black and/or graphite as conductive diluents and a powder fluoro-resin such as PTFE powder as a binding material is used (C4/L65-C5/L2).

Takeuchi and copending application are analogous because they are both concerned with the same field of endeavor, the manufacturing of a material for an electrochemical cell.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the ball mill for grinding, as taught by Takeuchi, with the method of mixing an agglomeration of powders, as taught by the copending application, for the purpose of grinding and mixing powders together.

Regarding claim 3, modified copending application discloses all of the claim limitations as set forth above. While Takeuchi discloses that the use of ball mill or vertical ball is preferred and typical grinding time ranges from between about 10 to 15 minutes (C4/L63-65), the reference does not explicitly disclose the method characterized in that the powders are mixed for more than 30 minutes. As the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said mixing time, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise mixing time cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mixing time in the method of Takeuchi to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions

of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

This is a provisional obviousness-type double patenting rejection.

20. Claims 4, 6, 17, and 21-22 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claim 1, in view of Sauer (US 4,336,217).

Regarding claim 4, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method of manufacturing an electrode including agglomerating a powder, the reference does not explicitly disclose the method wherein the agglomeration is carried out using a blender with blades rotating at 1000-3000 rpm.

Sauer discloses the method characterized in that agglomeration is carried out using a blender with blades (6) rotating at 1000-3000 rpm (C2/L27-30).

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the blender with rotating blades, as taught by Sauer, with the method of manufacturing an electrode, as taught by the instant application, for the purpose of blending and grinding an agglomerate.

Regarding claim 6, modified copending application discloses all of the claim limitations as set forth above. Sauer additionally discloses the method characterized in that an agglomeration time of at least 1 minute is used (C2/L34-39).

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the blender with rotating blades, as taught by Sauer, with the method of manufacturing an electrode, as taught by the instant application, for the purpose of blending and grinding an agglomerate.

Regarding claim 17, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the powder mixture comprises 55-75 wt% activated carbon or graphite and 25-45 wt% PTFE.

Sauer discloses the method characterized in that the powder mixture comprises 55-75 wt% **activated carbon** or graphite and 25-45 wt% PTFE (see "preferably 3:1 to 2:1", C2/L15-19).

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the activated carbon and PTFE in the given weight percent, as taught by Sauer, with the method of making an electrode, as taught by the copending application, for the purpose of making an electrode with balanced electroconductive and hydrophobic properties.

Regarding claim 21-22, while the copending application discloses the method of manufacturing an electrode including agglomerating a powder, the reference does not explicitly disclose the method characterized in that said steps are performed in a continuous production line, and the method characterized in that said gas diffusion layer and said active layer are produced in parallel continuous production lines and said production lines are combined in the combining step.

Sauer discloses a method of agglomerating PTFE and carbon that takes place in a mixer (1) with paddles (3) and knives (6). After the treatment, the agglomeration is removed via outlet port (8) into a storage container (10) (C2/L36-39). The container (10) has a drive (11) for powder transport (C2/L43-45) that appears to be in a shape of stirring apparatus (Figure 2). It would have been obvious to one of ordinary skill in the art at the time of invention to simultaneously add an organic solvent, as disclosed by Plowman, with the storage tank and drive, as taught Sauer, for the purpose of creating a creating a paste or dough to form a gas diffusion layer or active layer.

After the mixture leaves the storage container (10) of Sauer, the mixture moves into a crusher (12) with a rotating disk (13) to assure that material is pourable through inlet chute (14) in order to reach the rollers (15) (C2/L42-49, Figure 2). In other words, the crusher and the chute appear to work together as an extrusion apparatus that feeds into rollers which act as a calendering apparatus as the paste/dough/mixture passes through.

Afterwards, the calendered material (16) passes through a second roller set (19) where a woven metal band (18) (a current collector) is calendered to the material (16) (C2/L50-56). It would have been obvious to one of ordinary skill in the art at the time of invention to combine the calendering process of an additional substance, as taught by Sauer, with the method of making an electrode, as taught by the copending application, for the purpose of preparing both active and gas diffusion layers simultaneously and calendering them together in a seamless finishing process.

This is a provisional obviousness-type double patenting rejection.

21. Claim 5 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, in view of Sauer (US 4,336,217), as applied to claims 1 and 4 above, and further in view of Plowman et al. (US 4,581,116).

Regarding claim 5, the modified copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the powders are heated to a temperature to a temperature in the range of 50-200C prior to step (a)

Plowman discloses in that the powders are heated to a temperature of 50C for 16 hours overnight and at 150C for on additional hour.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the heating of the agglomerate to a temperature rang of 50-150C, as taught by Plowman, with the agglomerate powder, as taught by the copending application, for the purpose of ensuring the powders are dry.

This is a provisional obviousness-type double patenting rejection.

22. Claims 7-8 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claim 1, in view of Santilli et al. (US 5,651,813).

Regarding claim 7, the modified copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method

characterized in that agglomeration is carried out using a high-speed mill with rotating blades which rotate at more than 10,000 rpm.

Santilli discloses a process of making ink jet inks including introducing a mixture into a mill, and milling the mixture until the pigment particle size is below 1.5 μm (C2/L20-35). It is additionally disclosed that milling can take place in any suitable grinding mill including a ball mill but a high speed mill is preferred (C3/L22-25). The high speed mill can contain a rotating shaft with one or more impellers (blades) and it is disclosed that sufficient milling media velocity is achieved when the mill is operated at 9,000 rpm (C3/L28-35).

Santilli and the copending application are analogous because they are concerned with the similar problem of grinding and mixing a particle to a desired size.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the high speed mixer, as taught by Santilli, with the method to agglomerate the particles, as taught by the copending application, for the purpose of making an agglomeration to a desired size via grinding.

Regarding the claim limitation of the speed at which the high speed mill is operated (e.g. "with rotating blades which rotate at more than 10,000 rpm"), as the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said rotation speed, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise rotation speed cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized,

by routine experimentation, the rotation speed in the method of Santilli to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

Regarding claim 8, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the agglomeration time is from 10 seconds to 5 minutes. As the operational cost of grinding and mixing and desired particle and agglomeration size are variables that can be modified, among others, by adjusting said mixing time, with said operational cost and desired particle or agglomeration size respectively increasing and decreasing, the precise mixing time cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mixing time in the method of Santilli to obtain the desired balance between the operational cost and the particle size (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

This is a provisional obviousness-type double patenting rejection.

23. Claim 10 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claims 1 and 9, in view of Gascoyne et al. (US 2002/0015879).

Regarding claim 10, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the agglomerate is heated during stirring.

Gascoyne discloses an improved fuel cell anode structure ([0017]) wherein the anode structure the gas diffusion layer may contain carbon powder such as graphitised carbon, and a polymer such as PTFE ([0027]). Gascoyne continues to disclose a dispersion of carbon-based component, specifically 30 weight parts of high surface area carbon black, and a catalyst component, specifically 100 combined weight parts of platinum and ruthenium catalyst ([0051]). To this is added 10 weight parts of PTFE as a dispersion in water and the mixture is heated and stirred to entrain the PTFE particles within the carbon catalyst materials ([0051]).

Gascoyne and the copending application are analogous because they are both concerned with the same field of endeavor, the making of an electrode for a fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the stirring while heating an aqueous dispersion of PTFE and carbon, as taught by Gascoyne, with the method of making a paste from an organic solvent and agglomerate, as taught by the copending application, for the purpose of entraining the PTFE particles within the carbon catalyst materials.

This is a provisional obviousness-type double patenting rejection.

24. Claims 11 and 13 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claims 1, in view of Kato (US 6,054,230).

Regarding claim 11, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the paste is extruded into a thin film prior to calendering.

Kato disclose a method to make an electrode consisting of graphite particles (95 wt%) and PTFE resin particles (5 wt%) by conventional paste-forming methods in which the particulate materials were mixed together, lubricated, ram-extruded to form a tape, and calendered to form an electrode sheet (C9/L4-7).

Kato and the copending application are analogous because they are both concerned with the same field of endeavor, the making of an electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the ram-extruded process to form a tape prior to calendering, as taught by Kato, with the method of making an electrode, as taught by the copending application, for the purpose shaping the dough so the calendering process can be performed more easily because the dough has been more effectively distributed.

Regarding claim 13, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the powder mixture which is agglomerated is 100 wt% graphite.

Kato discloses a method to make an electrode consisting of graphite particles (95 wt%) and PTFE resin particles (5 wt%) by conventional paste-forming methods in which the particulate materials were mixed together, lubricated, ram-extruded to form a tape, and calendered to form an electrode sheet (C9/L4-7). In other words, the powder mixture which is agglomerated is 100 wt% graphite and it is agglomerated with PTFE to form an electrode that is 95 wt% graphite and 5 wt% PTFE.

Kato and the copending application are analogous because they are both concerned with the same field of endeavor, the making of an electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite particles of 95 wt% in an electrode, as taught by Kato, with the agglomeration with PTFE, as taught by the copending application, for the purpose of providing an electrode sheet that displays properties of high electroconductive and lower hydrophobicity.

This is a provisional obviousness-type double patenting rejection.

25. Claims 14-15 and 24 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claim 1, in view of Binder et al. (US 3,854,994), and further in view of Solomon (US 4,440,617).

Regarding claims 14-15, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the method characterized in that the powder mixture forming the active layer comprises 27-75 wt%

graphite with platinum, and 27-75 wt% graphite, nor comprising graphite with Ag, Co, Fe, perovskites or spinells.

Binder discloses a method of making a porous electrode having an electrically conductive electrocatalytically active layer and a contiguous gas permeable hydrophobic layer comprising polytetrafluoroethylene and carbon powder and graphite fibers (abstract). To enhance the strength and electrical conductivity of the material, graphite fibers or commercial graphitic felt are added (C4/L36-41).

Binder and the copending application are analogous because they are both concerned with the same field of endeavor, the making of a gas permeable electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite fibers or graphite felt, as taught by Binder, with the PTFE powder, as taught by the copending application, for the purpose of making a gas diffusion electrode with enhanced strength and electrical conductivity.

While the references disclose a gas diffusion electrode comprising PTFE and graphite, the references do not explicitly disclose the active layer comprising graphite with platinum, nor with Ag, Co, Fe, perovskites, or spinells.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). For the active layer, the concentration of PTFE in the electroconductive carbon/PTFE mix ranges from about 10 to 40 weight parts of PTFE and from about 60 to 90 weight parts of high surface area carbon to make up 100 weight parts of mix upon drying (C8/L19-23). It is additionally disclosed that platinum can be deposited on the active layer surface (C9/L68-C10/L2),

or other precious metal catalysts such as silver can be deposited to enhance the catalytic activity of the carbon (C10/L16-24).

Solomon and the copending application are analogous because they are both concerned with the same field of endeavor, the making of a gas electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the weight percent of the electroconductive carbon and catalyst metals including platinum and silver, as taught by Solomon, with the PTFE powder, as taught by copending application, for the purpose of making a gas diffusion electrode with enhanced catalytic activity.

Regarding claim 24, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45 wt% PTFE and the active layer comprising 25-75 wt% activated carbon or graphite with noble or non-noble metal catalyst and 25-75 wt% activated carbon or graphite with high surface area (> 100 m2/g) and 5-20 wt% PTFE, the gas diffusion layer and active layer being manufactured according to the method in claim 1.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). Solomon continues to disclose that active carbon can have a BET surface area of from about 1000 m2/g and higher (C6/L65-C7/L2). For the active layer, the carbon black or active carbon particles are combined intimately with the PTFE particles in a procedure referred to as "teflonating" (C8/L13-16). Additionally the concentration of PTFE in the carbon/PTFE

mix ranges from about 10 to 40 weight parts of PTFE and from about 60 to 90 weight parts of high surface area carbon to make up 100 weight parts of mix upon drying (C8/L19-23). It is additionally disclosed that platinum can be deposited on the active layer surface (C9/L68-C10/L2), or other precious metal catalysts such as silver can be deposited to enhance the catalytic activity of the carbon (C10/L16-24).

Solomon and the copending application analogous because they are both concerned with the same field of endeavor, the making of a gas electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the high surface area active carbon containing platinum in the weight percents as stated above, as taught by Solomon, with the active layer of an electrode, as taught by Plowman, for the purpose of having an active layer with high electrical conductivity and many active sites to facilitate the desired reaction.

The copending application modified by Solomon still does not explicitly disclose the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45 wt% PTFE.

For the gas diffusion layer, Binder discloses a method of making a porous electrode having an electrically conductive electrocatalytically active layer and a contiguous gas permeable hydrophobic layer comprising polytetrafluoroethylene and carbon powder and graphite fibers (abstract, C3/38-43). To enhance the strength and electrical conductivity of the material, graphite fibers or commercial graphitic felt are added (C4/L36-41).

Binder and the copending application are analogous because they are both concerned with the same field of endeavor, the making of a gas permeable electrode.

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the graphite fibers or graphite felt, as taught by Binder, with the PTFE powder, as taught by the copending application, for the purpose of making a gas diffusion layer with enhanced strength and electrical conductivity.

Regarding the limitation of the weight percent of the activated carbon or graphite and PTFE in the gas diffusion layer (e.g. "the gas diffusion layer comprising 55-75 wt% activated carbon or graphite and 25-45% wt% PTFE"). As the electroconductivity and hydrophobicity are variables that can be modified, among others, by adjusting said weight percents, with said electroconductivity and hydrophobicity increasing and decreasing respectively with an increase in the weight percent of activated carbon or graphite, the weight percent cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the weight percents of activated carbon or graphite and PTFE in the method of the copending application modified by Solomon to obtain the desired balance between the electroconductivity and hydrophobicity (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144.

This is a provisional obviousness-type double patenting rejection.

26. Claim 16 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379, as applied to claim 1, in view of Solomon (US 4,440,617).

Regarding claim 16, the copending application discloses all of the claim limitations as set forth above, but the references are silent to the physical characteristics of said PTFE with a particle size less than 1mm added to the mixture before the agglomeration step.

Solomon discloses a method of making a non-bleeding gas electrode comprising a high surface area electroconductive carbon and PTFE (abstract). In the active layer, the porous carbon particles are combined with a hydrophobic agent, PTFE (C8/L5-8). The particulate PTFE is disclosed as having individual particle sizes ranging from 0.05 to about 0.5 microns (C8/L8-10).

It would have been obvious to one of ordinary skill in the art at the time of invention to use the particulate PTFE having individual particle sizes ranging from 0.05 to about 0.5 microns, as taught by Solomon, with the PTFE particles for forming an active layer or gas diffusion layer, as taught by the copending application, for the purpose of reducing the mixing time as particles of small size do not have to be mixed or ground as long to become a desired smaller size.

This is a provisional obviousness-type double patenting rejection.

27. Claim 20 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/634379 in view of Plowman et al. (US 4,581,116).

Regarding claim 20, the copending application discloses all of the claim limitations as set forth above, but the reference does not explicitly disclose a method characterized in that said electrode is dried at a temperature less than 40C.

Plowman does disclose that subsequent to lamination of the active layer, current collector, and backing layer, the electrode was heated to 200C to remove VARSOL, the organic solvent (C11/L68-C12/L2).

It would have been obvious to one of ordinary skill in the art at the time of invention to combine drying method by heating to remove the organic solvent, as taught by Plowman, with the method of making an electrode, as taught by the copending application, for the purpose of drying and finishing the electrode.

But as the operational cost of drying or removing a solvent from a mixture and drying rate are variables that can be modified, among others, by adjusting said temperature of drying, with said operational costs and drying rate both increasing with an increase of temperature, the precise temperature cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the temperature of drying in the method of Plowman to obtain the desired balance between the operational cost and the drying rate (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the

optimum or workable ranges involves only routine skill in the art. (*In re Aller,* 105 USPQ 223). See MPEP 2144. Additionally, one of ordinary skill in the art would recognize the ability of air drying said electrode at ambient temperature.

This is a provisional obviousness-type double patenting rejection.

Conclusion

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jacob Buchanan whose telephone number is (571)270-1186. The examiner can normally be reached on Monday - Thursday 7:30-5:00 and alternating Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571)272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/J. B./
Examiner, Art Unit 1795

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1795